The question of the spontaneous ignition of coal scarcely meets with the treatment which its importance merits, and no reference is made to the work of the Royal Commission appointed in 1875 at the instigation of the Board of Trade and the Committee of Lloyd's to inquire into this subject. Many hundreds of vessels have without doubt been lost by the spontaneous ignition of coal cargoes, and there is a general belief that, with the considerable increase of temperature in steam-ships due to the introduction of high-pressure boilers and triple-expansion engines, the liability to spontaneous firing in the coal-bunkers is greatly augmented. The old idea of Berzelius, that the tendency to spontaneous ignition was mainly due to the presence of readily-oxidizable pyrites is now exploded. The experiments of Richters, Durand, and, in quite recent times, of Prof. Vivian Lewes, have shown that this substance has quite a subordinate effect. The cause is rather to be ascribed to the effect of absorbed or occluded oxygen upon finely-divided carbonaceous matter, *e.g.* dust or fine slack. The authors are also of this opinion, and state that the only method of preventing fire from such a cause is to keep the temperature of the mass of coal as low as possible by means of thorough ventilation by currents of air. In a paper recently read before the Institution of Naval Architects, in which this question is discussed, Prof. Lewes comes to the conclusion that this so-called ventilation is undoubtedly one of the most prolific causes of spontaneous ignition, and he instances the cases of the four colliers, *Euxine*, *Oliver Cromwell*, *Calcutta*, and *Corah*, which were loaded at Newcastle under the same tips, at the same time, with the same coal, from the same seam. The first three were bound for Aden, and were all ventilated. The *Corah* was bound for Bombay, and was not ventilated. The three thoroughly ventilated ships were totally lost from spontaneous ignition of their cargo, whilst the *Corah* reached Bombay in safety. Prof. Lewes points out that for ventilation to do any good, cool air would have to sweep continuously and freely through every part of the cargo, a condition impossible to attain, whilst anything short of that only increases the danger, the ordinary methods of ventilation supplying about the right amount of air to create the maximum amount of heating. A steam coal absorbs twice its bulk of oxygen, and takes about ten days to do it under favourable conditions, and it is this oxygen which in the next phase of the action enters into chemical combination and causes the serious heating.

One very remarkable change which is slowly making its way in this country is seen in the more extensive adoption of coal-washing machinery. Coal-washing machines have long been in use in Germany, France, and Belgium, and the exigencies of our iron manufacture are gradually necessitating their introduction in Great Britain, although the process has not yet reached the same degree of perfection as on the Continent. The effect of washing is to free the coal from pyrites and other mineral impurities. Of course it is only under special conditions that it can pay to subject the coal of this country to this process, but there is no doubt that as soon as the price of coal touches a certain point many coals which are practically unsaleable at present will be so treated. The authors describe a number of the more important coal-washing machines, and give details of their duty and cost.

The question of coking and coke-ovens naturally comes in for a very considerable share of attention, and practically all the more important methods are described and fairly well illustrated, and the general nature of the tars yielded by the various kinds of ovens is set forth, mainly on the authority of Mr. Watson Smith. One of the most valuable features in the work is the account given of the methods of using liquid fuel, and of the results obtained on various railways (principally Russian) and with various types of marine and stationary engines. The principles of domestic heating by solid and gaseous fuel, and relative efficiency of the various forms of open and closed grates and of gas stoves, are carefully stated, and considerable space is given to an examination of the modes of warming public buildings.

Analyses of boiler performances, and of the results obtained by mechanical stokers and by the application of gas-firing to boilers, methods of evaporation, with special reference to multiple effect apparatus, occupy a large portion of the section devoted to fuel in its applications to vaporization and evaporation ; and the concluding portions of the book are occupied by descriptions of special forms of kilns and furnaces.

The work is admirably printed, and on the whole well illustrated, and, what is very important in a book which is mainly a work of reference, it is furnished with an excellent index.

T. E. Thorpe.

THE SELKIRK RANGE.

Among the Selkirk Glaciers; being the Account of a Rough Survey in the Rocky Mountain Regions of British Columbia. By William Spotswood Green, M.A., F.R.G.S. (London : Macmillan and Co., 1890.)

The Canadian Pacific Railway, after crossing the watershed of the Rocky Mountains by the Hector Pass, descends for some four thousand feet into the valley of the Columbia River. This, for a hundred and seventy miles, flows in a northerly direction, parallel with the crest of the range. Then, after a great sweep to the west, it flows southward, parallel to its former course, till it receives the Kootenay, the head waters of which rise only a mile and a half away from its own. The mountain-tract insulated by these rivers is called the Selkirk Mountains. It lies roughly parallel with the Rockies, and yet further west are the Gold Range and the Cascades. Thus the railway traverses a mountain region until the valley of the Frazer River, by which it finally emerges, begins to broaden out towards the sea. It is, to use Mr. Green's words, " a region of vast ravines and wide valleys, whose sides, when not bare rock precipices, are clad in sombre forests, through which wild mountain torrents rush from glacier sources to placid lakes, where, after resting for a while and reflecting the hoary cedars and hemlocks, they issue forth as great rivers, and with swift current hurry on to lose themselves in the Pacific."

Though the peaks of the Selkirks look down upon the railway, their recesses, before Mr. Green's visit, were still almost unknown. The reason is not difficult to discover. The forests which clothe their lower slopes are unusually

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dense—often almost impenetrable; the traveller often has to force every step of his way among great trees, upright and prostrate, hampered by a frequent undergrowth, till the forest at last gives place to alder scrub which seems to possess all the offensive properties of the dwarf pine in the Eastern Alps, and to be a yet greater obstacle to the mountaineer. Even hunting-parties of Indians but rarely visit the Selkirks.

Mr. Green left England in the summer of 1888, with the intention of exploring and making a rough survey of the chief peaks and glaciers in the Selkirk Mountains. He was accompanied by a relative, the Rev. H. Swanzy, and took with him a mountain outfit and the requisite scientific instruments, lent by the Royal Geographical Society, who had made a grant in aid of the expense of the expedition. Convenient head-quarters were found at Glacier Hotel (4122 feet), where the trains, as at Göschenen on the St. Gothard, halt for meals; but many nights of the six weeks passed in this region were necessarily spent under canvas.

The portion of the Selkirk Range explored by Mr. Green lies mainly to the south of Rogers Pass (where the railway crosses the watershed of that range at a height of 4275 feet). It is bounded on the east by Beaver Creek, a tributary of the Columbia, and on the north by the Illecellewaet River, by which the railway descends. Many of the peaks rise above 10,000 feet; few, if any, surpass 11,000; Mount Sir Donald, which is possibly the highest, being 10,645. But the average elevation of the range is considerable, and as the peaks rise precipitously some 6000 feet above the valleys, the scenery is very fine. Though not comparable with that of the Pennine Alps, the mountain outlines are not inferior to those in some districts of the Tyrol; and the forests, where spared by the frequent fires, are far more grand. The snow-line is at about 7000 feet, the forests ending at about 6000 feet; the glaciers are numerous, and sometimes large, the most important, named the Geikie Glacier, being about 4 miles long and 1000 yards wide. As usual, old moraines and huge erratics indicate that they formerly extended far below their present limit. The Selkirk Mountains, it may be observed, correspond in latitude with the Mendip Hills.

The dominant rocks are rather fine-grained micaceous schists, the structure of which has evidently been much modified by pressure, so that it is difficult to say whether this has produced crystallization of the constituents or modified a rock once more coarsely crystalline. A snow-white quartzite or quartz-schist is also very conspicuous, and not seldom caps, and no doubt has helped to determine, the higher peaks. In one part the rocks have a yet more ancient aspect, while to the north of the railway, near some lead-mines, a black slate exhibits certain markings which may possibly be the remains of graptolites. So far as can be inferred from the specimens brought back by Mr. Green, the Selkirks are composed of either later Archæan or earlier Palæozoic rocks—probably, in great part, of the former.

That Mr. Green can use the pen as well as the pencil was proved by his former book, on "The High Alps of New Zealand." The present one deals with a more limited district, and does not include any climb equal in difficulty to that of Mount Cook; but the ascent of Mount Bonney, the second, if not the highest, peak in the Selkirks, offered more than one "bad place," and the difficulties of these excursions were enhanced by being made without guides, and in many cases only by the two travellers. Thus they not only had to be their own porters, and often carry a load of forty pounds over rough ground and up steep ascents, but also were only "two on the rope," a phrase which is significant to mountaineers. Their toils and hardships—and these were many—the physical features and natural history of the country, are all graphically described: in short, Mr. Green has written a book which not only is a record of a mountain survey carried out under exceptional difficulties, but also indicates that he possesses in an exceptional degree the qualifications for a scientific traveller, and that he can write as well as he can climb.

T. G. B.

THE ANATOMY OF THE FROG.

The Anatomy of the Frog. By Dr. Alexander Ecker, Professor of Human and Comparative Anatomy in the University of Freiburg. Translated, with numerous Annotations and Additions, by George Haslam, M.D., Scientific Assistant in the Medical Department in the University of Zürich; formerly Assistant-Lecturer in Physiology in the Owens College, Victoria University, Manchester. Illustrated with many Wood Engravings and Two Coloured Plates, executed by Hofmann, Würzburg, Bavaria. (Oxford: Clarendon Press, 1889.)

THE rapid advance of physiology and morphology since the completion of Profs. Ecker's and Wiedersheim's "Anatomie des Frosches" has intensified the desire for a text-book which should deal in the most exhaustive manner with the anatomy of the frog, "the physiological domestic animal." Dr. Haslam remarks in his preface that he has done his best to bring the original of "Ecker's Frog" up to date, and in this task he has thoroughly succeeded. More than one hundred new figures, of which one-third are original, have been added, and copious lists of references to frog literature have been drawn up. He has restricted himself to the most careful and concise description of the various organs, and has abstained from entering into the discussion of such morphological questions as bear upon the comparison of the Anura with other Vertebrata. It would therefore be out of place to criticize the retention of names which—like atlas for the first free vertebra—if applied to the frog alone, are perfectly clear in their meaning, although their true morphological value, and therefore true denomination, may possibly be different. Every anatomist knows the difficulties connected with the frog's first spinal or hypoglossal nerve; its description on p. 182 will enable the reader to form his own opinion as to which of the three or four names he may adopt.

The first section of the book, dealing with the bones and joints, has remained unaltered, but the nomenclature generally used by English anatomists has been adopted throughout. The different nature of the clavicles and the precoracoid elements has been correctly described according to investigations made since the appearance of the German original in 1864. Howes's researches on the composition of the carpus and tarsus came too late to be embodied in the English edition, but the occipito-cervical region might have been more extensively treated.

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